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(54) **Protective container with a fluid-tight seal for the underground installation of tanks containing pressurised liquefied gas**

Schutzbehälter mit Flüssigkeitsdichtung für die unterirdische Installation von Tankbehältern enthaltenden unter Druck stehenden Flüssiggases

Récepteur protecteur avec joint d'étanchéité pour l'installation souterraine de réservoirs contenant du gaz liquéfié sous pression

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- **PETROLE INFORMATIONS/GPL ACTUALITE,**  
**no.1690, December 1992, PARIS FR pages 46 -**  
**51, XP334866 'LA CITERNE ENTERREE DE**  
**PRIMAGAZ: ETERNELLA'**

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**EP 0 624 752 B1**

## Description

The present invention relates to a protective container with a fluid-tight seal for the underground installation of tanks containing pressurized liquefied gas, as for instance is known from FR-A-748 880.

The invention also relates to underground installations obtained by the use of protective containers of this type with fluid-tight seals.

As is known, tanks containing pressurized liquefied gas are usually installed above ground close to the places where the gas is to be used, which may be factories, restaurants or private houses.

In the latter case, particularly when it is in a garden, the overground installation of the tanks is unattractive from the aesthetic point of view since it is not always possible to conceal them adequately.

In order to overcome this disadvantage, it is already known to install tanks underground; however, in this case, in accordance with current technology and in order to satisfy safety standards, when the excavations have been carried out, a concrete pit has to be provided and made impermeable in order to prevent the surrounding land being contaminated if the tank is damaged.

One example of this technology is illustrated in European Patent application EP-A-0 251 917.

However, producing cisterns made of concrete requires the establishment of a building site, however small, the presence of masons and a protracted level of inconvenience in addition to the necessary inconvenience involved in excavating the land.

In accordance with further current technology illustrated, for example, in the journal "GPL ACTUALITE" of December 1992, the underground installation of tanks occurs with the latter disposed in a horizontal position in a sealed, high-density polyethylene shell which can only be inspected by remote control using a telecamera.

This known technology, whilst enabling the production of concrete containment cisterns to be avoided as far as possible, nevertheless requires the occupation of a large area of the garden or locality where the tank is to be installed.

Furthermore, this becomes somewhat complex and expensive, particularly when it is a matter of installations for domestic use.

The object of the present invention is to overcome the above disadvantages and to allow tanks containing pressurized liquefied gas to be installed underground such that they occupy as small a space as possible, in accordance with the dimensions of the tank, which can easily be concealed, in such a way that the aesthetic aspects of the installation location can also be satisfied and a greater level of safety and control of the operating conditions of the tank can be ensured as can the easy supplying of the tank.

This object is achieved by the invention set forth in the appended claims.

The invention will now be described in greater detail

with reference to non-limiting embodiments illustrated in the appended drawings, in which:

Figure 1 shows a view in section of a first embodiment of a protective container with a fluid-tight seal in accordance with the invention, installed in the excavated ground and without the top;

Figure 2 shows the container of the preceding Figure with a first type of tank containing a pressurized liquefied gas, installed in the container;

Figure 3 shows the container of Figure 2 with the top in the closed position;

Figures 4, 5, 6, 7 and 8 show structural details of the protective container of the preceding Figures on an enlarged scale;

Figure 9 shows an exploded perspective view of a second embodiment of the protective container according to the invention containing a second type of tank;

Figure 10 shows the container of Figure 9 in position in an open cavity, partially in cross-section;

Figure 11 shows the container of the preceding Figure in the buried position;

Figure 12 shows a detail of the top of the container according to the embodiment of Figure 9 with the cover on the hatch, in section;

Figure 13 shows a partial section of the cover;

Figures 14 and 15 show the means for connection between the top and the peripheral wall of the container in the embodiment of Figure 9, in section.

With reference to Figures 1 to 8, the protective container with a fluid-tight seal according to the invention is indicated 1.

A container of this type, which is preferably made of plastics material, although the use of metal or prefabricated concrete is not excluded, comprises a peripheral wall 2 with stiffening ribs 3 and a base 4.

Whilst a base of this type is rigidly connected to and is preferably integral with the peripheral wall 2, the upper part of the container has an opening 5 which is closed by a top 6 which is in the shape of a conical roof in the embodiment illustrated in Figure 2. A top 6 of this type comprises a hatch 7 provided with a cover 8 which can be secured in position by means of conventional bolts 9.

In the example shown in Figures 3 and 4, the hatch 7 is provided in alignment with the longitudinal axis X-X of the container 2.

As can be seen from Figures 1 and 2, the protective

container 1 is installed in a cavity in the ground and is disposed along the longitudinal axis X-X in the vertical position, leaving the top 5 open in order to allow the gas tank 10, which is likewise in the vertical position, to be introduced.

The tank 10 is provided with feet 11, which are integral with the base 12, and a filler connector 13 disposed in correspondence with the upper cap 14.

The conventional safety valve 15 and a gauge 16 for checking the internal pressure are provided adjacent the connector 13 on the tank 10.

The connector 13, the safety valve 15, the maintenance assembly with the checking pressure gauge 16, as well as level indicators and outlet connections for the liquid phase and any other parts necessary for the operation, are assembled on the cap 14 of the tank 10 in a position such that they are accessible through the hatch 7 when the tank 10 is disposed inside the container 1.

The transverse dimensions of the protective container 1 are larger than the transverse dimensions of the tank 10 such that a space 17 is produced around the tank.

This space 17 is preferably filled with inert material 18, such as, for example, sand, to form ballast for the container and to reduce the volume which may possibly be occupied by the gas in the event of an accidental loss from the tank 10.

Alternatively, instead of sand, non-corrosive anti-freeze liquid can be introduced which can be heated by a heater 181 which can consist of an electrical resistance or a tube through which hot water or steam passes by conventional supply systems.

By controlling the temperature in the space 17 and the pressure in the tank 10 in this way, the degree of vaporization of the liquefied gas can be regulated and maintained constant.

A reduction of this type in the volume also reduces the possibility of explosive air / gas mixtures forming, increasing the safety of the installation.

In correspondence with the edge 19 of the container 1, tie rods 20 for anchoring the tank 10 such that the latter is stably positioned against the base 4 of the protective container are provided about the top opening 5.

The tie rods 20 can be secured to the tank by means of corresponding studs 21, integral with the cap 14 of the tank, and nuts 22 (Figure 4).

The top 6 is provided with a collar 23 which is disposed about the hatch 7 and extends towards the interior of the container 1 and thus towards the tank 10 when the latter is positioned inside the container (Figure 6).

Similarly, on the cap 14 and about the maintenance assembly, the tank 10 is provided with a collar 24 which is rendered integral with the cap 14 itself, for example by means of welding, and which is disposed coaxially with the collar 23 of the wall 6.

A seal 25 is provided between the facing ends of the collars 23 and 24 and the connection components in the form of eccentric tie rods are schematically indicated 26.

Also, in correspondence with the edge 19 of the container 1 and the corresponding edge 27 of the top 6, there are provided a seal 28 and a series of coupling members 29, also of the eccentric type, distributed about the periphery of the container 1.

As can be noted from the above description, when the tank 10 has been placed in position, the container 1 is closed by the top 6. Action on the anchorage means 26 and 29 produces above the cap 14 a space 30, which is connected to the space 17 and is completely sealed from the exterior.

The space formed by the space 17 and the space 30 together can, if necessary, be used to control any losses from the tank 10 containing pressurized liquefied gas.

For this purpose, a sensor 31 held on the wall 6 and connected to a signalling and warning apparatus 32 is located inside the space 30.

A possible variation of the pressure inside the spaces 17 and 30, detected by the sensor 31, can be indicative of incorrect sealing of the tank 10 and thus initiates the operation of the signalling and warning device 32.

With reference to the embodiment illustrated in Figures 9 to 15 and in which the elements corresponding to those of the embodiment in Figures 1 to 8 are indicated by the same reference numerals, it can be seen that the base 4 of the protective container 1 is provided with a plurality of eye-bolts 33 for connection to a ballast plate 34 for holding the container 1 in position in the cavity and to balance it against any hydrostatic forces which would tend to force it out of the cavity.

The eye-bolts 33 are to engage, in known manner, rings 35 countersunk in the concrete of the ballast plate 34 by means of bolts 36.

In accordance with the latter embodiment of the protective container 1, the top 6 is provided with a flat radial lip 37 to be superimposed on a corresponding radial lip 38 provided on the edge of the opening 5 defined by the peripheral wall 2. An annular seal 39 is interposed between the lip 37 and the lip 38 and the connection means consist of a clamp 40 with a screw coupling 41.

As can be seen in particular in Figure 12, the top 6 is provided with a housing 42 in which an annular seal 43 is disposed by means of which the top 6 rests on the upper cap 14 of the tank 10.

From the above, it will be appreciated that action on the screw coupling 41 causes the clamp 40 to tighten the lips 37 and 38 relative to one another, at the same time determining the adherence of the seal 43 against the cap 14 of the tank 10.

In this way, as in the embodiment described in Figures 1 to 8, a space 17 with a fluid-tight seal is determined about the tank 10 containing the liquefied gas.

In this embodiment also, the space 17 can be filled with non-corrosive anti-freeze liquid which may possibly be heated by a heater 181 using the method and advantages described above.

Again, the top 6 is provided with a pair of eye-bolts

44 used for moving the assembly during its installation.

Referring in particular to Figures 9 and 12, it can be seen that the collar 23 disposed about the hatch 7 is provided with a radial appendage 45 and an external thread 46.

The latter thread is to engage a counter-thread 47 on the cover 8.

The latter is provided with an internal cavity 48 which extends axially over a portion along the collar 23 where the thread 46 is provided, and which is filled with fire-resistant material, indicated 49 in Figure 9.

For example, this material may consist of cement lightened with expanded clay or vermiculite.

Alternatively, fire-resistant charged expanded polyurethanes can also be used.

The cover 8, which can in turn be made from self-extinguishing plastics material such as, for example, high-density polyethylene (945 g/l), is provided with a radial appendage 50 to be superposed on the appendage 45 when the cover has been screwed onto the thread 46.

A locking member 51, which can be actuated by a key 52, is used to lock the appendage 50 on the appendage 45 and thus to prevent the cover 8 from being unscrewed and removed by unauthorized persons.

The engagement between the locking member 51 and the appendages 45 and 50 is produced so as to resist possible tampering but nevertheless can be unscrewed if a greater thrust at a predetermined load, for example, a pressure of between 0.35 and 0.45 bar, should be produced below the cover 8, following possible losses of gas.

In this case, the engagement between the thread 46 and the counter-thread 47 would not even be capable of resisting and the cover 8 would be automatically expelled, giving vent to the gas and avoiding dangerous explosions.

A further advantage connected with this cover structure, in addition to being fire-resistant, is that even agricultural equipment can travel over it without risk of damage to the buried tank.

Once installed, the tank 10 can be repeatedly refilled via the charging connector 13 after the cover 8 has been removed from the hatch 7 without the latter impairing the sealing conditions of the space 17.

The underground installation according to the invention is thus hardly visible above the ground since in practice only the cover 8 of the hatch 7 remains in view and at the same time it adequately satisfies the safety standards.

It is therefore easy to conceal the installation if necessary, for example by means of a bush or by installing a parapet in the form of a false well or even by other aesthetically pleasing constructions which are in keeping with the surrounding environment.

From the above description, it becomes clear that the inherent advantage is in the rapid preparation of the location of the tank 10 as a result of the presence of the protective container 1 which is self-supporting and is

hardly larger than the transverse dimensions of the tank itself which can thus be transported together with the latter.

## Claims

1. A protective container (1) with a fluid-tight seal for the underground installation of tanks (10) containing pressurized liquefied gas, comprising a peripheral wall (2) which can surround the tank (10), forming a space (17), a base (4) for supporting said tank (10), and a top (6) provided with a hatch (7), a cover (8) and means (29, 40, 41) for releasable connection to said peripheral wall (2), characterized in that said top wall (6) has a collar (23) aligned with the hatch (7), the collar (23) having an axial end supported at the front on the pressurized liquefied gas tank (10) when the latter is in position, sealing means (25, 43) being provided between the end of the collar and the tank.
2. A protective container according to Claim 1, characterized in that the base (4) is associated with a ballast plate (34).
3. A protective container according to Claim 1, characterized in that said peripheral wall (2) and said top (6) are both provided with respective radial lips (38, 37), adjacent and opposite one another with the interposition of a seal (39).
4. A protective container according to any one of Claims 1 to 3, characterized in that said means for connecting the top (6) to said peripheral wall (2) consist of tie rods (29).
5. A protective container according to any one of Claims 1 to 3, characterized in that said means for connecting the top (6) to the peripheral wall (2) consist of an annular strip with a screw coupling (with eye-bolts), the annular strip being in engagement with the radial lips (37, 38) of the edges of the top and the peripheral wall.
6. A protective container according to any one of Claims 1 to 5, characterized in that said hatch (7) is provided with a cover (8) shaped with an internal cavity (48) containing a fire-resistant material (49).
7. A protective container according to Claim 6, characterized in that the cover (8) extends over an axial portion of the collar (23), engaging the latter by a thread (46) and a counter-thread (47) provided respectively on the outer surface of the collar (23) and the inner surface of the cover.
8. A protective container according to Claim 7, characterized in that the cover (8) and the collar (23) are

- provided with respective radial appendages (45, 50) which are superposed on one another when the cover (8) is screwed into the closure position on the hatch (7), a locking member (51) with a key (52) being interposed between the radial appendages (45, 50).
9. A protective container according to Claim 8, characterized in that the locking member (51) with a key can be automatically disengaged from the radial appendages (45, 50) when it overcomes a predetermined axial load on the cover (8) acting from the interior of the collar (23).
  10. A protective container according to Claim 1, characterized in that it comprises anchorage means (20) for holding the pressurized liquefied gas tank (10) stably when it is disposed inside the container (1).
  11. A protective container according to Claim 1, characterized in that it comprises a sensor (31) which measures the pressure inside said space (17, 30) and a warning signal apparatus (32) actuated by said sensor (31) when the pressure conditions inside said space (17, 30) do not correspond with the preset conditions.
  12. A protective container according to any one of Claims 1 to 11, characterized in that the space (17) contains a non-corrosive anti-freeze liquid and is provided with a heater element (181).

#### Patentansprüche

1. Ein Schutzbehälter (1) mit einer fluid-dichten Dichtung für die unterirdische Installation von Tanks (10), die unter Druck stehendes, flüssiges Gas enthalten, der eine periphere Wand (2), die den Tank (10) umgeben kann, um einen Zwischenraum (17) zu bilden, eine Basis (4) zum Tragen des Tanks (10) und eine Oberseite (6), umfaßt, die mit einer Luke (7), einer Abdeckung (8) und einer Einrichtung (29, 40, 41) zur lösbaren Verbindung mit der peripheren Wand versehen ist, dadurch gekennzeichnet, daß die obere Wand (6) einen Ring (23) aufweist, der mit der Luke (7) ausgerichtet ist, wobei der Ring (23) ein axiales Ende aufweist, das an der Vorderseite auf dem unter Druck stehenden Tank (10) für flüssiges Gas getragen ist, wenn letzterer in Position ist, wobei eine Abdichtungseinrichtung (25, 43) zwischen dem Ende des Rings und dem Tank vorgesehen ist.
2. Ein Schutzbehälter gemäß Anspruch 1, dadurch gekennzeichnet, daß die Basis (4) einer Ballastplatte (34) zugeordnet ist.
3. Ein Schutzbehälter gemäß Anspruch 1, dadurch gekennzeichnet, daß die periphere Wand (2) und die Oberseite (6) beide mit jeweiligen radialen Rändern (38, 37) benachbart und gegenüberliegend mit einer Dichtung (39) dazwischen vorgesehen sind.
4. Ein Schutzbehälter gemäß einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Einrichtung zum Verbinden der Oberseite (6) mit der peripheren Wand (2) aus Zugstangen (29) besteht.
5. Ein Schutzbehälter gemäß einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Einrichtung zum Verbinden der Oberseite (6) mit der peripheren Wand (2) aus einem ringförmigen Streifen mit einer Schraubenverbindung (mit Augenschrauben) besteht, wobei der ringförmige Streifen mit den radialen Rändern (37, 38) der Kanten der Oberseite und der peripheren Wand Eingriff nimmt.
6. Ein Schutzbehälter gemäß einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Luke (7) mit einer Abdeckung (8) versehen ist, die mit einem internen Hohlraum (48) gebildet ist, der ein feuerfestes Material (49) enthält.
7. Ein Schutzbehälter, gemäß Anspruch 6, dadurch gekennzeichnet, daß sich die Abdeckung (8) über einen axialen Abschnitt des Rings (23) erstreckt, wobei sie mit dem letzteren durch ein Gewinde (46) und ein Gegengewinde (47), die auf der äußeren Oberfläche des Rings (23) und auf der inneren Oberfläche der Abdeckung vorgesehen sind, Eingriff nimmt.
8. Ein Schutzbehälter gemäß Anspruch 7, dadurch gekennzeichnet, daß die Abdeckung (8) und der Ring (23) mit jeweiligen radialen Erweiterungen (45, 50) versehen sind, die sich einander überlagern, wenn die Abdeckung (48) in die geschlossene Position auf der Luke (7) geschraubt ist, wobei ein Verriegelungsbauglied (51) mit einem Schlüssel (52) zwischen den radialen Erweiterungen (45, 50) angeordnet ist.
9. Ein Schutzbehälter gemäß Anspruch 8, dadurch gekennzeichnet, daß der Eingriff des Verriegelungsbauglieds (51), das einen Schlüssel hat, mit den radialen Erweiterungen (45, 50) automatisch gelöst werden kann, wenn eine vorbestimmte axiale Last auf die Abdeckung (8) überschritten wird, die aus dem Inneren des Rings (23) wirksam ist.
10. Ein Schutzbehälter gemäß Anspruch 1, dadurch gekennzeichnet, daß er eine Verankerungseinrichtung (20) umfaßt, um den unter Druck stehenden Tank (10) mit flüssigem Gas stabil zu halten, wenn dieser innerhalb des Behälters (1) angeordnet ist.

11. Ein Schutzbehälter gemäß Anspruch 1, dadurch gekennzeichnet, daß er einen Sensor (31), der einen Druck innerhalb des Zwischenraums (17, 30) mißt, und eine Warnsignalvorrichtung (32) umfaßt, die durch den Sensor (31) aktiviert wird, wenn die Druckbedingungen innerhalb des Zwischenraums (17, 30) nicht den voreingestellten Bedingungen entsprechen.
12. Ein Schutzbehälter gemäß einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß der Zwischenraum (17) eine nicht korrodierende, nicht-frierende Flüssigkeit enthält und mit einem Heizelement (181) versehen ist.

### Revendications

1. Récipient protecteur (1) avec un joint d'étanchéité pour l'installation souterraine de réservoirs (10) renfermant un gaz liquéfié sous pression, comprenant une paroi périphérique (2) pouvant entourer le réservoir (10), formant un espace (17), une embase (4) pour supporter ledit réservoir (10), et une partie supérieure (6) pourvue d'une trappe d'accès (7), un couvercle (8) et des moyens (29, 40, 41) de raccordement détachable à ladite paroi périphérique (2), caractérisé en ce que ladite partie supérieure (6) possède un collier (23) aligné avec la trappe d'accès (7), le collier (23) possédant une extrémité axiale supportée à l'avant, sur le réservoir de gaz liquéfié sous pression (10), lorsque celui-ci est en position, des moyens de fermeture étanche (25, 43) étant prévus entre l'extrémité du collier et le réservoir.
2. Récipient protecteur selon la revendication 1, caractérisé en ce que l'embase (4) est associée à une plaque de ballast (34).
3. Récipient protecteur selon la revendication 1, caractérisé en ce que ladite paroi périphérique (2) et ladite partie supérieure (6) sont toutes deux pourvues de lèvres radiales respectives (38, 37), adjacentes et opposées l'une à l'autre avec un joint d'étanchéité (39) interposé entre elles.
4. Récipient protecteur selon l'une quelconque des revendications 1 à 3, caractérisé en ce que lesdits moyens de raccordement de ladite partie supérieure (6) à ladite paroi périphérique (2) se composent de tiges de raccordement (29).
5. Récipient protecteur selon l'une quelconque des revendications 1 à 3, caractérisé en ce que lesdits moyens de raccordement de ladite partie supérieure (6) à ladite paroi périphérique (2) se composent d'une bande annulaire à accouplement à vissage (à boulons à oeil), la bande annulaire étant en engagement avec les lèvres radiales (37, 38) des bords de la partie supérieure et de la paroi périphérique.
6. Récipient protecteur selon l'une quelconque des revendications 1 à 5, caractérisé en ce que ladite trappe d'accès (7) est pourvue d'un couvercle (8) formée d'une cavité interne (48) renfermant un matériau ignifuge (49).
7. Récipient protecteur selon la revendication 6, caractérisé en ce que le couvercle (8) s'étend sur une partie axiale du collier (23), engageant ce dernier par un filet (46) et un contre-filet (47) prévus respectivement sur la surface extérieure du collier (23) et la surface intérieure du couvercle.
8. Récipient protecteur selon la revendication 7, caractérisé en ce que le couvercle (8) et le collier (23) sont pourvus d'appendices radiaux respectifs (45, 50) superposés l'une sur l'autre lorsque le couvercle (8) est vissé en position de fermeture sur la trappe d'accès (7), un élément de verrouillage (51) et une clé associée (52) étant interposés entre les appendices radiaux (45, 50).
9. Récipient protecteur selon la revendication 8, caractérisé en ce que l'élément de verrouillage (51) et une clé associée peuvent être automatiquement désengagés des appendices radiaux (45, 50) lorsqu'il vainc une force axiale prédéterminée s'exerçant sur le couvercle (8) et agissant de l'intérieur du collier (23).
10. Récipient protecteur selon la revendication 1, caractérisé en ce qu'il comprend des moyens d'ancrage (20) pour maintenir stable le réservoir de gaz liquéfié sous pression (10) lorsqu'il est disposé à l'intérieur du récipient (1).
11. Récipient protecteur selon la revendication 1, caractérisé en ce qu'il comprend un capteur (31) qui mesure la pression à l'intérieur dudit espace (17, 30) et un appareil à signal avertisseur (32) activé par ledit capteur (31) lorsque les conditions de pression à l'intérieur dudit espace (17, 30) ne correspondent pas aux conditions préétablies.
12. Récipient protecteur selon l'une quelconque des revendications 1 à 11, caractérisé en ce que l'espace (17) renferme un liquide antigel non-corrosif et est pourvu d'un élément de chauffage (181).

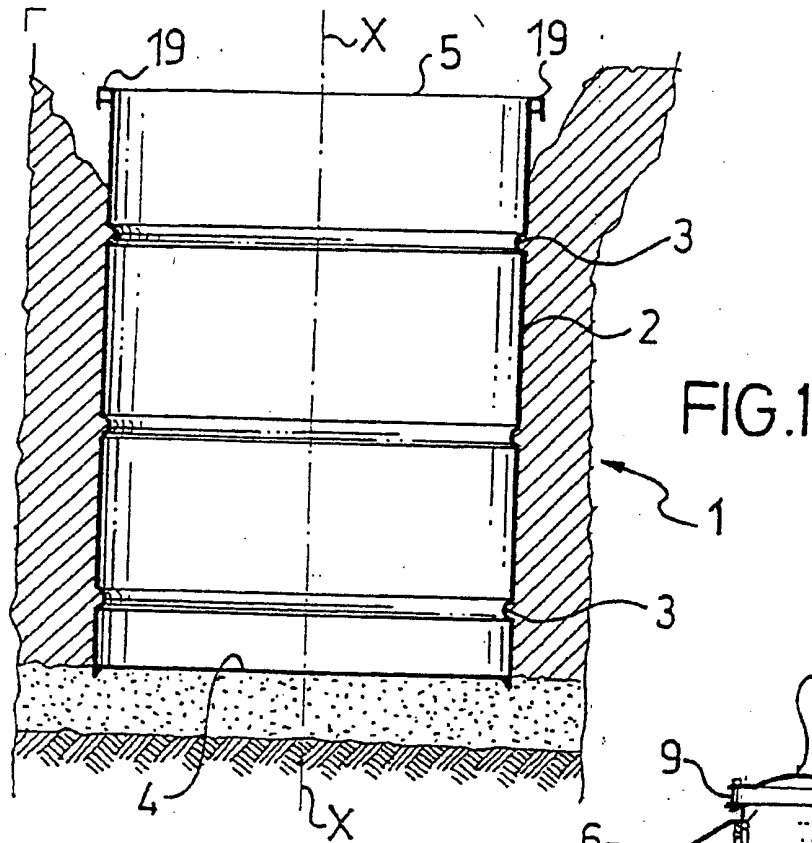
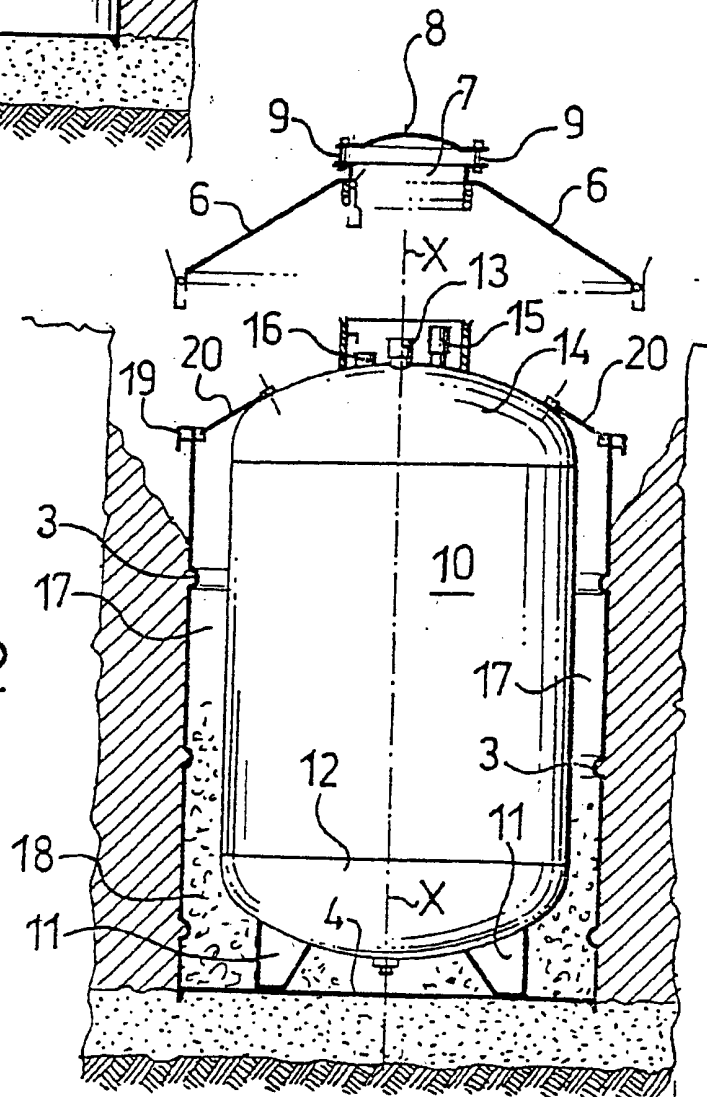


FIG. 2



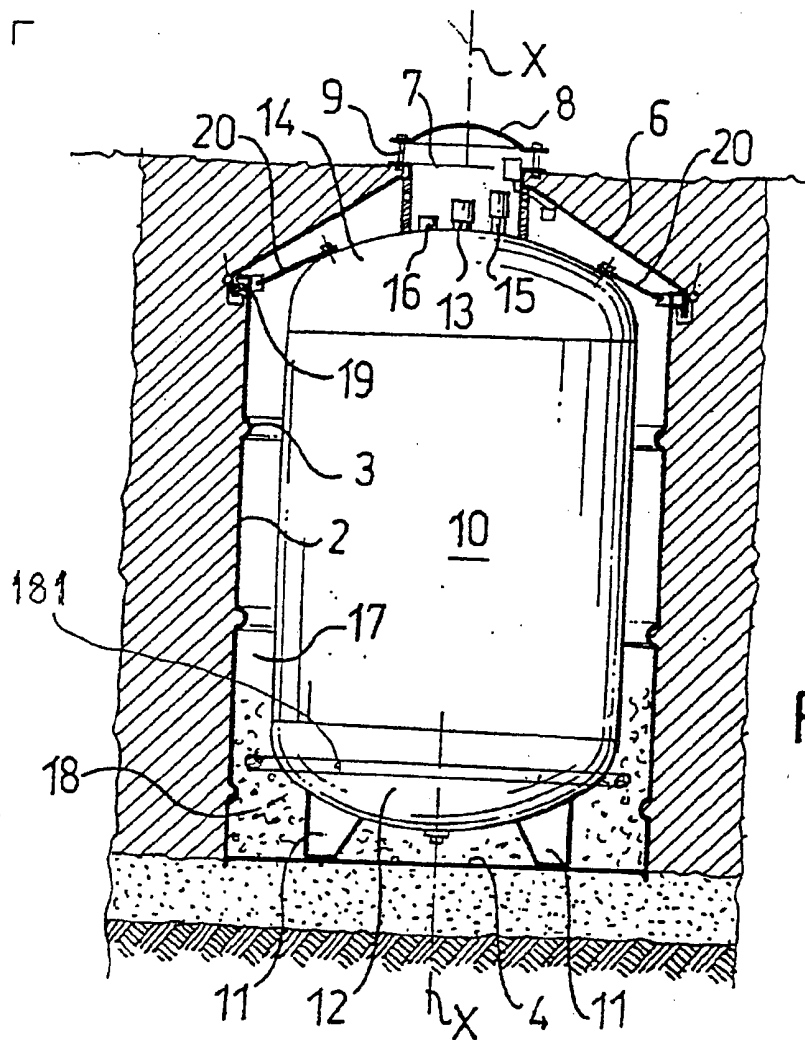


FIG. 3

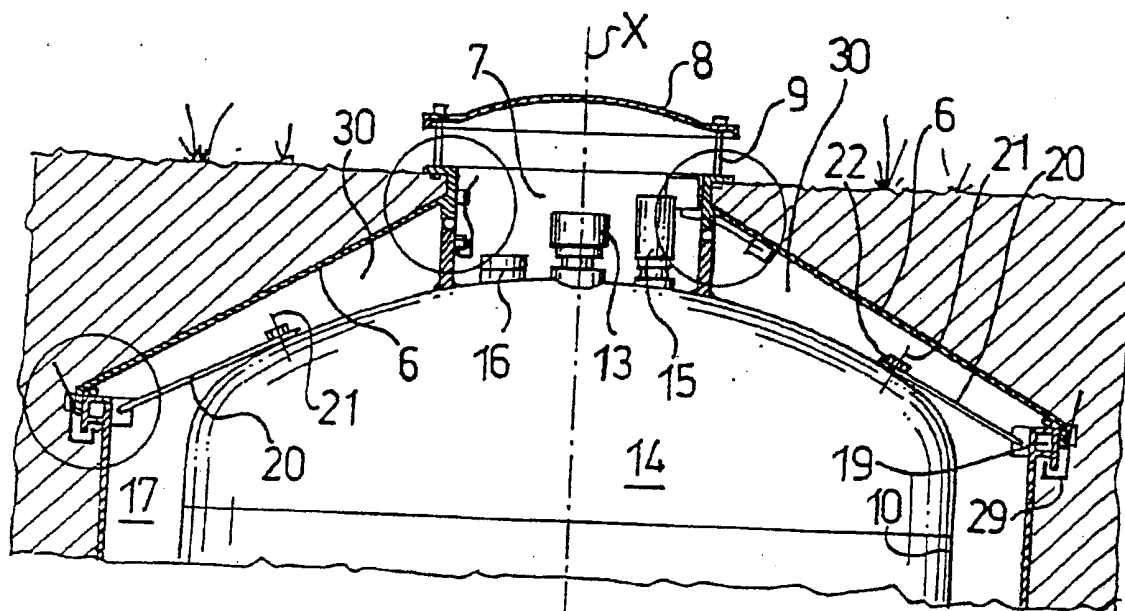


FIG. 4



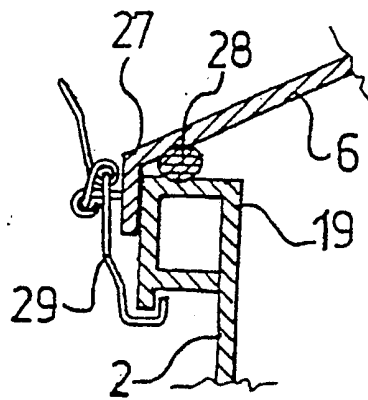


FIG. 5

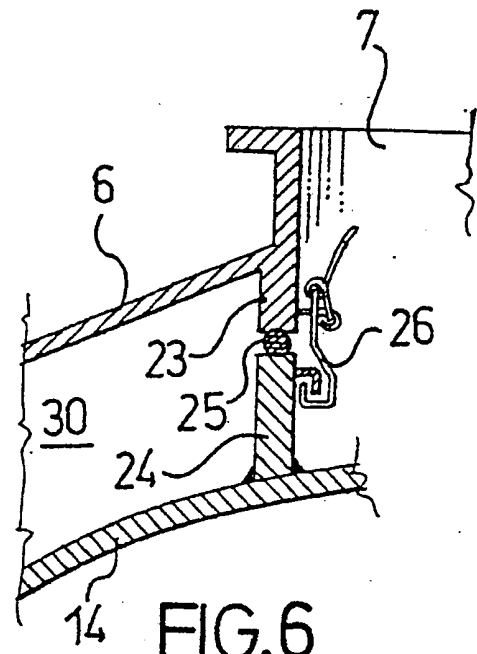


FIG. 6

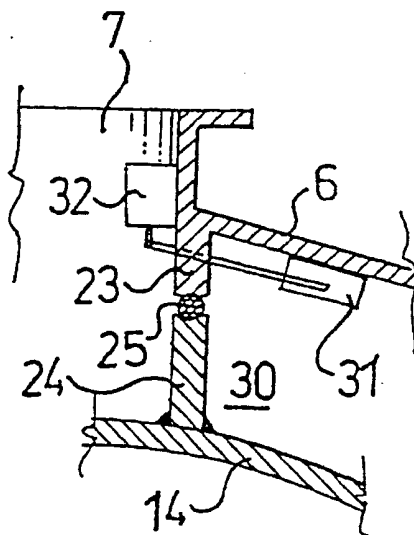


FIG. 7

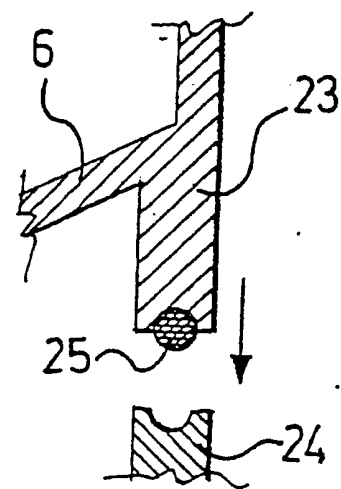


FIG. 8

